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RESOURCES OF THE PRYOR MOUNTAIN WILD HORSE RANGE

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This report was prepared and submitted by the following Denver Service Center personnel:

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Overlays and maps were prepared by members of Engineering Division, Denver Service Center.

RESOURCES OF THE PRYOR MOUNTAIN
WILD HORSE RANGE

Table of Contents

Page No.

Location 1
Background 1
History of Grazing Use 2
Geology and Topography 5
Climate 6
Vegetation 7
Soils of the Area 8
Water Supply and Yield 12
Erosion and Sediment Yield 14
Adequacy of Existing Data 16
    1. Range Survey 16
    2. Range Condition 18
    3. Range Trend 19
Range Potential 21
Management Implication 22
Wildlife of Pryor Mountains 24
Mule Deer Habitat 26
Key Browse Species 29
Cover and Water 30
Browse Studies 30
Population Dynamics 33
    1. Harvest 33
    2. Productivity 35
Needs for Additional Data 37
References 38

Appendices:

#1 - Table of Precipitation at Stations Surrounding Pryor Mountain Horse Range 40
#2 - Deaver, Wyoming Weather Station (past 11 years data) 41
Lovell, Wyoming Weather Station (past 11 years data) 42
Bridger, Wyoming Weather Station (past 11 years data) 43
#3 - Major Plant Species Found on Horse Range 44
#4 - Pryor Mountain Range Survey Map and Legend 46
#5 - Condition, Trend, and Utilization Data for Cercocarpus ledifolius from five study plots 47
#6 - History of Hunting Seasons in Pryor Mountain Area, 1952-1968 49

Appendices (continued): **Page No.**

#7 - Hunter Harvest Statistics from Mail Questionnaire Surveys for the Pryor Mountains Area 51
#8 - Winter Deer Classifications from the Pryor Mountain Area 52
#9 - Summary of Physical Soil Characteristics of Mapping Units 53
#10- Soil Information, Wild Horse Range, Pryor Mountains Montana 55
#11- Pryor Mountain Soil Survey Map 69

RESOURCES OF THE PRYOR MOUNTAIN WILD HORSE RANGE

Location

The Pryor Mountain Wild Horse Range is located northeast of Lovell, Wyoming along the Montana-Wyoming border. The boundaries of the 31,000 acre refuge as described in the Federal Register of Thursday, September 12, 1968, are outlined in red on the base map.

Background

Subsequent to the Secretary's establishment of the Pryor Mountain Wild Horse Range the Director named a 7-member committee to study the area in the Pryor Mountains of Montana and Wyoming.

Mr. George Turcott, co-chairman of the committee and Chief, Division of Resource Standards and Technology in the BLM Washington Office, requested the Denver Service Center Director to appoint a team of Denver Service Center Standards and Technology personnel to assist the Director's special Pryor Mountain Wild Horse Range Advisory Committee. Representatives of the Range, Wildlife, and Watershed Management Staffs were assigned this task. The objectives of the team were:

1. To evaluate existing resource information and data available on the Wild Horse range.

2. Prepare a summary report using overlays and a narrative of the existing data found to be currently valid. Also photographs depicting condition and situations should be obtained. The evaluation should be a technical assessment of vegetation (kind and condition), soil and moisture relationships that will provide a basis for recommendations relating to rangeland-watershed management and habitat management. Style should be semi-technical and understandable by non-technicians.

3. Identify the need for additional data that may aid the Director's Commiitee in its recommendations.

The information in this report was collected and assembled October 14th through the 26th, 1968, using data from the Montana State Office, the Billings District, the Montana Fish and Game Department, and the team's observation of the Wild Horse Range itself.

Included with the report is a base map of the area with the following overlays: Vegetative types, range condition, range trend, allotment boundaries, soil associations, wildlife, and erosion areas. Also included is an album of colored photographs depicting the conditions within the horse area.

History of Grazing Use.

There is little documentation of grazing use prior to 1929. However, the range survey report which included the area of the Horse Range makes several comments on early use. Much of this information was gathered from verbal communication with old timers.

The survey report states that the season of use in early days was year round since no hay was provided. Primary use was by cattle,

sheep, and horses. They grazed the area from the open range period on through the homestead era which ended shortly after 1919. Large bands of sheep were run in the area, each band containing 2-to 3,000 head.

In 1959 the University of Wyoming published a report on the Big Horn Basin. In discussing the history of the area the report comments as follows on page 9: "Despite the handicap of poor transportation facilities, the cattle industry might have remained a flourishing one had it not been for the severe winter of 1886-1887. Most of the cattlemen were taking advantage of the usual open winters for year-round grazing, hence, had no reserve feed supplies. They had little time to replace their severe losses before sheepmen and homesteaders began to arrive in large numbers. The first sheep were brought into the basin in 1871 by J. D. Woodruff, who established a claim in the Owl Creek area and built the first cabin in the basin. The operation did not last long, however. The first extensive bands to utilize the area were sheep owned by the Mormon colonizers who settled around Meeteetse and along the Shoshone River in the 1890's. By the turn of the century, many of the cattle ranches had been converted to sheep ranches."

The earliest documented use comes from the case file of W. E. Tillett. He stated that from 1929 to 1933 he had 225 cattle and 17 horses that grazed on public domain in Montana both east and west of Crooked Creek

and in Wyoming east of Crooked Creek. The use was spring, fall, and winter.

Tillett's commensurate property record, dated 1936, indicated he would run on public domain in the fall if there was enough to feed. He preferred an individual allotment between Crooked Creek and Dryhead Ridge in Montana and Wyoming.

Tillett's 1938 application was approved for 255 cattle and 15 horses from May 20 to October 15, 33% Federal range and 174 AUM's.

In 1939 he was granted an individual allotment east of Crooked Creek in Montana. See allotment overlay.

In 1940 he requested Paul Crouter, District Grazier, to remove the horses in trespass on the Crooked Creek Allotment east of Crooked Creek. There are several other letters in the file requesting action on trespass horses.

In 1956 the Wyoming and Montana licenses were combined. Tillett was now licensed for 451 AUM's in Crooked Creek Allotment.

In 1957 the base lands were divided equally between Bessie, Roy, Royce, and Lloyd Tillett. Each received 25 cattle use from April 1 to May 21, 55 cattle December 1 to December 31, and 10 horses March 1 to December 31 - 109 AUM's each.

In 1967 the Tilletts agreed to relinquish their grazing privileges in the Crooked Creek Allotment with the provision the horses remain.

The Dryhead Allotment (see allotment overlay) has been licensed to four operators for about 2,100 AUM's and 600 head of cattle or horses for the past 15 years. This includes spring, fall, and summer use. The licenses have varied considerably through the years. Some of these animals were grazed in the spring, some in the fall, and some in spring, summer, and fall into early winter. About 15 operators have trailed over 2,000 head of cattle through the Dryhead Allotment for many years. These cattle trail to and from private lands north of the horse area to base lands south of the area. Except for trailing through the Dryhead Allotment all livestock grazing has now been eliminated from the Horse Range.

Geology and Topography

The Pryor Mountains consist primarily of a limestone anticline surrounded by sandstone formations and shales. It is separated from the Big Horn Mountain Range by the Big Horn River Canyon. Mountain tops are nearly 9,000 feet, or some 5,000 feet above the lower parts of the area along the Big Horn River. High point in the Horse Range is about 8,000 feet.

Except for the sandstone rocklands and shales, the area is characterized by steep slopes and deeply incised canyons which restrict east-west movement of man and animals. Peninsular areas between some of the canyons are practically isolated and Sykes Ridge, a north-south

escarpment between Big Coulee and the Big Horn River, is a barrier to east-west travel from about the state line northward to Hough (Layout) Creek.

The sandstone and shale areas have deep eroded drainage channels and produce large quantities of sediment at every runoff event.

Climate

Precipitation amounts are unknown within the Horse Range. There are no recording stations within the area, or nearby at comparable elevations. Daily precipitation records have been maintained since July 1965 at the Tillet Fish Rearing Station south of Sykes Springs.

Prevailing winds are from the southwest, across the valleys of lowest precipitation. The climate is relatively dry, being influenced by high mountain ranges to the west which cause a loss of moisture before incoming air masses reach the area. At Deaver the temperatures are extreme, ranging from -42° to 106°F. The average is 44.5° for the year. July is the warmest, averaging 72° while January is the coldest with an average temperature of 17°. It is assumed these conditions are somewhat representative of the Horse Range.

From the Weather Bureau records and from isohyetal maps of Wyoming and Montana, it is estimated the mean annual precipitation amounts to 8" at the south edge of the Horse Range, to 13" plus at the northeast corner near Mystery Cave.

Appendix 1 includes summaries of data collected at weather stations surrounding the area.

Vegetation

The vegetative types, as shown on the overlay, are named from the general aspect or appearance of the dominant or most prominent vegetation. Type names used are standard throughout the BLM. The overlay was developed from the 1966 range survey data. A copy of the range survey map is attached. (Appendix 10)

The names of the types and approximate acreage are:

Standard Type Number	Type Name	Acres
1	Grass	300
4	Sagebrush	5,700
5	Mtn. Shrub	6,500
6	Conifer	3,400
9	Juniper	15,000

A complete species list is impractical, therefore only a partial list of species within each vegetative type is presented in Appendix 3.

The numbers following the scientific and common names in the appendix indicate the vegetative types, as numbered above, in which the species occur. This is a generalized approach and does not mean that these species occur only in these types.

Soils of the Area

The soils, as shown on the overlay, are not described individually but as soil associations. These are geographic connotations of various soils that occur in a characteristic pattern. A soil association may consist of from one to many soil types or mapping units. Descriptions of the many types of soil that might occur in a soil association would occupy much space and the reader would not get the general picture.

Appendix 9 is a summary table of the physical characteristics of each soil mapping unit. The column titled "Production Potential" means that you can expect this type of production under the best management for the particular mapping unit. Appendix 10 briefly describes all the mapping units. Appendix 11 is a copy of the soil survey map prepared by the Soil Conservation Service.

Soil Association A is the largest and consists of one mapping unit. It occurs at the higher elevations in the central and eastern portions of the unit on steep to very steep and mountainous terrain containing deep vertical-walled canyons. Most slopes are over 90 percent. (A one percent slope means a one-foot drop vertically for 100 feet of horizontal distance or, a 100 percent slope is a 45 degree angle.) Soils are shallow, dark-colored and limey and occur on small areas. Erosion is moderate. Vegetation is sparse, consisting of Douglas fir, juniper, and bluebunch wheatgrass toward the eastern side of the unit on the steeper and rougher area. Mountain mahogany, juniper, black sagebrush, and bluebunch wheatgrass comprise the principal species over the rest of the unit.

The B Soil Association occurs on steep to very steep ledgy, barren, or partially barren hard sandstone cliffs and slopes of 25 to over 90 percent. There are small isolated areas of shallow sandy soil. Erosion is critical. Vegetation is sparse, consisting of mountain mahogany, juniper, black sagebrush, bluebunch wheatgrass, and phlox.

The C Soil Association consists of four mapping units. Soils are shallow to very shallow with slight erosion. The 40F Skaggs-Trapper contains a fairly dense stand of Douglas fir. The 07 Rene stony loam unit is small and occurs above timberline. It contains alpine vegetation consisting of stunted shrubs and grasses. The 100 Lap Association supports sparse grass and sagebrush. The remaining unit is the 500 Limestone Rockland.

Soil Association D consists of the 100 Lap Association which is dominant and the 500 Limestone Rockland mapping units. Soils are shallow to very shallow and rocky. Erosion is slight due to the extreme rocky nature of the soil and the rockland itself. Vegetation consists of a sparse cover of black sagebrush and bluebunch wheatgrass.

The E Soil Association occurs as two separate areas, one toward the northwest corner of the range and the other in the southern portion. Mapping units 84B Shorey loam and 584B Shorey gravelly and stony loam comprise the association. These two areas are as productive as any

on the Horse Range. They contain deep loam to silty clay loam and gravelly to stony loam soils on gently sloping fan and stream terraces. Erosion is slight. Vegetation consists of big sagebrush, blue grama, and bluebunch wheatgrass.

Soil Association F consists of the 400 Red shale and Abac soils mapping unit and occurs on steep to very steep slopes of 50 to 90% and as vertical red cliffs. Soils are shallow and erosion is critical. The aspect is a sparse cover of juniper, bluebunch wheatgrass, and sagebrush.

Soil Association G contains two mapping units, 224F Midway and Travessilla and 27B Hysham clay loam. Soils are shallow clayey and sandy loams over shale and sandstone with the clayey soils containing a high sodium content. Erosion is critical. Vegetation consists of salt grass and greasewood with a sparse cover of juniper and rabbitbrush.

The H Soil Association contains some six mapping units, three of the units, 200 Shale outcrop, 300 Sandstone Rockland and 400 Red shale and Abac soils contain an enormous amount of barren consolidated and unconsolidated rock. The 400 unit is dominant. Erosion is critical and with a high sediment yield. Mapping units 91B and 91C Demijohn silty clay loam and 184C Shorey gravelly loam have potential for vegetative production. They contain deep soils but occur in a very low precipitation area. Erosion is critical. The vegetation

consists of big sagebrush, needle-and-thread grass, and bluebunch wheatgrass and scattered juniper.

Soil Association I is a relatively rough and rugged area with the mapping unit 500 Limestone Rockland predominating. Other mapping units include the 100 Lap Association and 402 Abac-Relan complex. Erosion is moderate. The vegetation consists of juniper, mountain mahogany, and bluebunch wheatgrass.

The J Soil Association has five mapping units. The 402, 403, and 29C mapping units contain the better soils varying from shallow to moderately deep. The remaining mapping units are the 100 and 500. Erosion is moderate. The vegetation is juniper, mountain mahogany, and bluebunch wheatgrass.

Soil Association K occurs on the east side of the Pryor Mountains on relatively smooth footslopes with drainages extending easterly toward the Yellowtail Reservoir. Mapping units 29C and 29D Crago stony and cobbly loam and 403 Abac stony loam make up the association. The dominant unit is 29D and it occurs on the more sloping portion of the bench immediately east of the mountain with 29C and 403 lying along the eastern portion of the unit. Productivity potential is good. The cobbly, rocky surface with cobbles throughout the soil profile would prevent any land treatment as far as seeding is concerned. Erosion is slight. The vegetative aspect is juniper along drainages and bluebunch wheatgrass and blue grama on the flats and broad ridges.

Water Supply and Yield

Crooked Creek is the only live stream within the Pryor Mountain Wild Horse Range. Sykes Spring and Britton Spring, located in the southeast and southwest corners of the area, respectively, are apparently the only other dependable sources of water. Sykes Spring is estimated to flow 5 gallons per minute and Britton Spring 10 gallons per minute. Several small seeps might be developed for wild horse and wildlife use, but such sources are limited and the quantities they might be expected to furnish are unknown.

Limited information is available on which to base estimates of water yield from the area. A stream gage station was established on Crooked Creek in December 1964 and abandoned in December 1967. The station site is below the mouth of Big Coulee which is the major watershed within the area. Gypsum Creek, to the west of the area, also flows into Crooked Creek above the station.

Water yield from the Pryor Mountain Wild Horse Range is approximately 3,200 acre feet per year. This is based on the average of the 3-year records of runoff at the USGS gage as applied to the Horse Range area.

U. S. Geological Survey gage records are summarized as follows:

Crooked Creek Station 1/ - 119 sq. mi. drainage area

	1965	1966 2/	1967	Average 3/
Runoff (acre feet)	10,560	5,160	7,805	7,842
Runoff (acre feet per sq. mi.)	88.7	43.4	65.6	65.9
Peak Discharge	1460 cu.f./sec.		August 20, 1965	

1/ Water rights totaling 25.8 cfs for irrigation of 1,820 acres and 103 ac. ft. for storage are located upstream from the station. Actual diversion and storage quantities are not known. Some of the diverted water no doubt returns to the stream above the gage. Diversions, storage, and return flow are not reflected in the estimates.

2/ The 1966 low runoff agrees with the precipitation records which averaged 76% below the mean in 1966.

3/ Runoff amounts to 1.24" per year. USGS estimates for Carbon County, Montana, are 0.4" and for Big Horn County, Wyoming, only 0.5". The Pryor Mountains runoff, as recorded by this gage, amounts to 2.5 to 3 times the water yield of the surrounding area.

Erosion and Sediment Yield

Erosion and resultant sediment yield from the Horse Range is an unknown quantity that cannot be determined with any degree of accuracy without measuring or sampling devices. Erosion varies from slight to extreme, depending upon geologic formations, soils, and cover.

An erosion overlay is provided which divides the area into several categories of present erosion conditions.

1. Slight erosion. Two areas are shown as having slight to low erosion. Both are well covered by vegetation; the northern area by trees and a good organic surface mantle; and the eastern area by grasses, shrubs, and litter where little erosion is occurring even on slopes of 40 to 45%. This second area appears to be indicative of what much of the soil productivity might be that occurs on the limestone rockland when the vegetative cover is protected from continuous grazing use. Apparently lack of water has restricted grazing pressure, although animals have been in the area.

2. Moderate erosion. The middle portion, and the area adjacent to the Big Horn Canyon, consists of practically barren (both vegetation and soil) limestone rockland. Presently, soil erosion and sediment yield are relatively low as there is little soil to erode from the limestone throughout this area. Some of the "flat" benches and ridges have a few small areas containing shallow soils with a

thin grama grass sod over the rock. There is a build-up effect under many of the shrubs where plant litter and wind-blown fine soil materials are accumulating. Much of the barren limestone surface is covered by small rock fragments. These are excellent soil building materials when combined with vegetation. However, plants have little chance of survival in the heavily grazed area and where high intensity summer storms and prevailing winds remove the rock fragments and fines before soil is tied down. An isolated area of moderate erosion lies to the south, surrounded by the critically eroded area. Here, the Shorey gravelly loam soil supports a good stand of sagebrush and blue grama grass.

3. Critical erosion. The southwesterly portion of the area consists of sandstone rocklands and shale complexes. These formations and the soils derived from them are highly erosive. The establishment or maintenance of a protective vegetative cover is difficult due to high salt content of the soils, low precipitation, and lack of protection from livestock and wildlife to permit recovery of native vegetation.

4. Sediment Yield. The areas shown on the overlay of slight erosion probably produce less than 0.2 acre feet of sediment per square mile per year. Areas of moderate erosion usually produce from 0.5 to 1.0 acre feet. However, with so little soil available to erode, actual sediment yield is estimated as less than 0.4 acre feet. In areas of

critical or worse erosion, sediment yields are in excess of 3.0 acre feet per square mile per year.

An estimate of the sediment yield from the Horse Range is in excess of 70 acre feet or 113,000 cubic yards per year. This is based on a classification method prepared for use in the Pacific Southwest. It is reasonably applicable in all arid and semi-arid areas of the West.

Adequacy of Existing Data

1. Range Survey. The survey field work was done during the summer of 1966. The procedures conformed to BLM standards. However, the survey was conducted so as to produce carrying capacity estimates for summer cattle grazing and deer winter use.

Horse grazing capacity was determined from adjustments made in the cattle capacity. These adjustments indicate that the range in Montana in the Crooked Creek Allotment would carry 35 horses year round. That portion in Wyoming - 4 horses - and that portion in the Dryhead Allotment - 20 horses - this totals to 59 animal units or horses and 708 animal unit months of use.

To overcome the inadequacy of the range survey for horse use, the cattle carrying capacity was adjusted by applying two factors. The first was a 15% deduction based on the fact that the horses used the range year round rather than seasonally like cattle; therefore, there would be less total capacity. The second was a 1.3 animal equivalent factor that was applied to horses. This was a total energy requirement relationship between cattle and horses taken from Morrison's feed and feeding text. The theory is that horses have a greater total energy requirement than cattle.

The following is an example from the Crooked Creek portion of the allotment. The area is rated at 650 animal unit months for cattle. This was converted to horse capacity by the following process:

Year round use deductions

650 - (15% x 650) = 552 AUM's

Animal equivalent deduction

552 ÷ 1.3 = 425 AUM's

Year round horse capacity

425 ÷ 12 months = 35 animal units

Part of the procedures for a range survey are utilization deductions. These are judgment values applied in percent to areas where it has been determined that livestock cannot make full use of the available feed. The main criteria for these deductions are slope, rocks or stones, heavy timber, lack of water, or unstable soils. On very steep or rough areas these deductions amount to 100%. When the 100%

deductions are inserted in the grazing formula, it produces a zero carrying capacity. When a lesser number, say 15%, is run through the formula the grazing capacity would be reduced by 15%.

Almost 7,500 acres within the Crooked Creek Allotment have been classed as unusable for cattle by applying the 100% utilization deduction. Most of these deductions were for slope. These deductions that were based on cattle use were also used in estimating the horse capacity of the range. See Appendix 4 - all vegetative types preceded by the numeral 7 are classed as unusable.

Many of the other vegetative types have varying degrees of deduction which are less than 100 percent. The acreage of these is unknown.

The utilization deductions from the survey, the 15% deduction for year round horse use, and the total energy requirement between cattle and horses, are to some extent arbitrary. However, they do not appear to be unreasonable in terms of general site conditions and the application of principles used successfully elsewhere.

2. Range Condition. Range condition has been called range health. Condition is relative and when a specific piece of range is described as being in a particular kind of condition, the description is relative to a standard or ideal for that kind of range. It involves the whole watershed complex.

The area was covered by a Deming two-phase range condition and trend study in 1959 and again in 1963. This was a Bureau approved method of determining condition and trend. The following comparison shows a considerable amount of deterioration within a 5-year period.

Range condition by the Deming two-phase method:

	Good	Fair	Poor	Bad	Unusable
1959	9%	48%	37%	6%	
1963	9%	38%	5%	31%	17%

The above studies included more area than the Horse Range.

The range condition overlay reflects the 1963 Deming two-phase report. Three degrees of condition have been used on the overlay; good, fair and poor. None of the area within the Horse Range is in good condition. About 3,500 acres is in fair condition with the remainder classed as poor. Part of the range in fair condition is in the northeast corner of the Horse Range in the Dryhead Allotment. There is indication that animals (both cattle and horses) have been there but not much evidence of use due to lack of water. Most of the remainder of the fair condition range is north of the Tillett Ranch.

3. Range Trend. Trend is change in the vegetation and soil as a direct result of environmental factors, primarily climate and grazing. It may be expressed by changes in the vegetation; changes

in species, numbers of plants or ground cover, reproduction, size or health of plants, the amount of litter on the soil surface. The soil also expresses trend by the presence or absence of erosion.

The range trend shown on the overlay was also determined by the Deming two-phase method. The overlay indicates that about 2,500 acres is improving, 2,250 acres static and the remainder is deteriorating.

Five trend study plots have been established on the area. The locations are shown on the overlay. The sites were located and the plots installed by Duane Whitmer of the Billings District. The vegetal cover was described and measured and photographs were taken for the first time this year. Therefore, there is no comparative data.

The subcommittee's examination of the range was confined to areas within 1/2 mile on either side of the roads or trails. From the evidence, it appears that the condition and trend studies are accurate. One area in the NE corner showed evidence of improvement. On this site many of the broom snakeweed plants are dying and being replaced by grass. On a few other areas there appeared to be slight improvement. However, this may have been a reflection of the better rainfall this past year.

Range Potential

Plants that have not been grazed give some indication of potential. These are found under shrub canopies and in inaccessible places. The more desirable grass species such as bluebunch wheatgrass and needle-and-thread found in these areas are in sharp contrast to the open sites where three awn, blue grama, phlox and annual weeds predominate. The quality and vigor of these protected plants suggest that much of the area is capable of supporting a greater quantity and quality of vegetation than now present.

There are open areas where grasses have managed to survive. This suggests the existence of a micro-climate favorable for seed germination and the establishment of grasses if protection is provided.

The erosion payement and thin soils in the central portion of the area create a harsh, dry micro-climate that presents unique difficulties to plant establishment and survival. These sites, though not subject to continuing displacement,may remain bare for long periods.

There is a considerable amount of evidence that points to past overgrazing. Many of the grass plants have hollow centers, others appear stunted. There are abnormally large spaces that contain little or no vegetation. There are also ridges of vegetation which stand above wind scoured depressions. Wind blown deposits of soil under mountain mahogany plants were sometimes several inches higher than

the surrounding soil surface. There are well-defined trails on some of the slopes and many of the shrubs exhibit an abnormal growth form from hedging.

Management Implications

The horse has habitat requirements like any other animal. To provide the yearly needs of an animal there has to be a balance between food, cover, and water. There may be a serious shortage of seasonal range (particularly during winter) if the area is tightly fenced and the animals confined.

If the potential of the range is ever to be achieved, grazing control that will allow periodic rest to the vegetation is a prerequisite. This implies fencing and the initiation of a grazing system. Our observations indicate that the horses are broken up into very small bands, each containing a stallion. If they are confined to smaller pastures the large number of stallions may cause problems.

There is also the problem of moving the horses from one pasture to another. Restraining the animals from water to get them to enter another pasture may not work in the northern part of the area because there are many small depressions that catch and hold rainwater.

Other than Crooked Creek and the abandoned mine in Section 7 of T9S, R28E, all of the permanent water is in the southern part of the unit.

Without trail development it is doubtful if horses can get water from Crooked Creek north of the Tillett Ranch due to the steep canyons. The distribution of animals is closely related to the location of water, therefore if management is to succeed, properly located water developments are a necessity. This is especially important on the east side of the Horse Range.

The yearly precipitation data from three weather stations surrounding the Horse Range has been graphically presented over an 11-year period in Appendix 2. These are included to illustrate the variability in rainfall that occurs in semi-arid regions. This variability is probably more normal than unusual.

It is generally accepted that there is a close relationship between total precipitation and herbage yield and that herbage production may vary tenfold between dry and wet years.

Dry years, if they occur back to back, may have greater significance in changing the vegetation than the normal years. An extreme condition, though infrequent and perhaps of short duration, may be the chief factor influencing or controlling the vegetation on a site.

Under these conditions the numbers of animals that can obtain adequate nourishment from a given area over an extended period must be based on these extreme conditions, not on the so-called normal conditions.

Wildlife of Pryor Mountains

The Pryor Mountains provide habitat for a variety of wildlife. Three species of game birds, one native and two exotic, occur within the boundaries of the Horse Range. Blue grouse, the native species, inhabit the Douglas fir zone at higher elevations. (A flock of five blues was observed on the Horse Range near Mystery Cave on October 17, 1968.) Hungarian partridges generally occupy the lower elevations. (A flock of 11 huns was seen in Section 23, T58N, R95W on October 22, 1968.) Chukars could be seen almost anywhere on the Horse Range since they are usually found in steep, rocky terrain. The density and distribution of these birds is not well known nor is hunting effort and success well documented.

Three species of mammalian carnivors--coyote, bobcat, and black bear--are known to frequent the Horse Range. (On October 17, 1968 fresh bobcat and black bear tracks were seen in the snow one or two hundred yards west of Mystery Cave.) Mountain lions may be present but there are no recent documented records.

Habitat for aquatic species is very limited. About two and one-half miles of Crooked Creek flows through the western edge of the Horse Range providing habitat for cutthroat and brook trout. This portion of Crooked Creek is fished, but fishing pressure and fisherman success is not well known.

Prairie dogs have not been reported on the Horse Range recently but have been seen within a mile or so of the boundary. Black-tailed prairie dogs (Cynomys ludovicianus) probably occur on the range, and on October 19, 1968 a white-tailed prairie dog (Cynomys leucurus) was observed two and one-fourth miles west of the Horse Range. The white-tailed prairie dog is of particular interest to students of mammalogy in Montana because south central Montana is the northern extremity of the range of this rodent. (Reference #8)

Bighorn sheep were part of the endemic fauna of the Pryors; three bighorn skeletons were found in the Pryors the past summer by archeological survey crews of the University of Montana. William T. Hamilton reported in Trapping Expedition (1848-49) as follows: "There were plenty of sheep on Pryor Mountain...We soon came out from behind the rocks with the band plainly in view. There must have been sixty or seventy of them." The decline and eventual extinction of the Pryor Mountain bighorns was probably due to a combination of factors, namely, competition for food with domestic stock, uncontrolled hunting and disease. Food habit studies of bighorn sheep on other areas generally show that bighorns use about 70 to 75 percent grass, grass-like plants and forbs, and 25 to 30 percent browse species. Bighorn food habits would, of course, vary in different areas; but in most situations domestic sheep and livestock would be directly competitive for forage. Lungworms have been implicated as a contributing or primary cause of mortality among

bighorns in Montana (References #3 & 12) and could have caused mortalities in the Pryors. The importance of the area now included in the Wild Horse and Wildlife Range to previous populations of bighorns is unknown; however, they very likely used Sykes Ridge and probably adjoining areas.

There is no known documentation of elk being endemic to the Pryors, but it seems reasonable to assume they were. Elk are native to the adjacent Bighorn Mountains to the southeast. Elk from the Bighorn Mountains currently winter along the eastern rim of the Bighorn Canyon along the boundary of the Horse Range, and there is reason to believe animals from the Bighorns could have moved into the Pryors in the past. The small number of elk presently in the Pryors could be descendants of original stock or from elk transplants made on the Crow Indian Reservation.

Mule deer are the major big game species of the Horse Range, and their relationship to the Range is discussed in the following sections,

Mule Deer Habitat

Mule deer, like all other animals, have basic requirements essential to life and reproduction, namely, food, water, cover and space or elbow room. In order to satisfy these basic requirements, the Pryor Mountain deer make seasonal movements to various parts of the mountain where these essentials are available.

1. Summer range. The Pryor deer herd spend summers in the high country, the Douglas-fir canyons, aspen groves and sagebrush-grasslands. Most of the summer range is in the Custer National Forest northwest of the Wild Horse Range. In the early spring deer make their greatest use of grass when it first greens up. During other seasons grass is a minor food item. Forbs and new shrub growth make up the major components of the summer diet.

There are doubts in the minds of game biologists if the Pryor Mountain summer ranges are adequate to support a thrifty, productive deer herd at the present population level. A Montana State University graduate student, Mr. John Firebaugh, is currently making a summer study of mule deer - livestock range use and deer population dynamics in the Pryor Mountains. This is a cooperative effort by the Montana Fish and Game Department and Montana State University. Mr. Firebaugh's study should be completed in the summer of 1969 and hopefully will provide insight into the adequacy of the Pryor Mountain summer range for deer.

2. Intermediate range. Intermediate range is that portion of the deer range between the summer and winter ranges. On many western ranges migrating deer spend a month or more on these ranges. In the Pryors intermediate range is practically non-existent and this deficiency increases the grazing impact on both the summer and winter ranges.

3. Winter range. Deer rely, to a large extent, on browse in winter when forbs and grasses are dry and not particularly nutritious. On the winter diet of browse, deer generally lose weight and as soon as the snow recedes in spring and green-up starts, they move to the higher ranges.

The winter range of the Pryor Mountain deer herd is a major determinant of the number of deer the entire area can support. The most important parts of the winter range of the Pryor Mountain deer herd are on the Wild Horse Range. The wildlife overlay shows the general location of the deer winter ranges on the Horse Range. Crucial areas, as delimited on the overlay, are areas within the general deer winter range where deer concentrate during periods of adverse weather. These areas are considered essential to the herds' survival. There are two crucial areas which overlap portions of the Horse Range. The most important is the large one which includes the upper part of Big Coulee, Sykes Ridge and that part of the Horse Range in the Bighorn Canyon National Recreation Area. This part of the winter range supports a dense stand of mountain mahogany and provides good cover. The other crucial area is along the western boundary of the Horse Range between Tillett Ranch and the Custer National Forest. This western area has small scattered patches of mountain mahogany and sagebrush with very limited amounts of fourwing saltbush and skunkbush sumac. This western area is not as important as the eastern one because of the limited carrying capacity due to low density of browse. Cover is excellent with juniper providing most of the vegetative cover.

Key browse species. The most important browse species on the winter range is mountain mahogany. This plant is important because it is abundant, productive, nutritious, and is preferred by mule deer. The only deer winter food habit studies made in the Horse Range were rumen analyses of six deer taken in the Dryhead area in November 1959. These data showed browse made up 67 percent, forbs 33 percent, and grass 0 percent of the contents. The major browse plant in this sample was mountain mahogany.

Biologists and range specialists working in the Pryors have considered this plant curlleaf mountain mahogany, Cercocarpus ledifolius, but the growth form and leaves appear to be more like littleleaf mountain mahogany, Cercocarpus intricatus. Littleleaf mountain mahogany, according to the Range Plant Handbook (Reference #4) does not attain tree size, and leaves are about one half as long as curlleaf and are so strongly rolled under at the margins as to appear narrowly linear. This description generally fits the mahogany found on the Horse Range.

Exact identification might seem trivial, but this plant is the key species, and management could be different for the two species of mahogany. A game manager would probably want greater browsing pressure on the typical form of curlleaf than on littleleaf. This would be to keep the treelike form from growing out of reach of deer as often happens on curlleaf ranges.

Until the taxonomic questions are resolved we shall use the nomenclature of Plummer, et. al. in Intermountain Range Plant Symbols, 1966, where he lists _Cercocarpus_ _ledifolius_ _intricatus_ as curlleaf mountain mahogany. Other browse species on the winter range include black sagebrush, big sagebrush, Utah juniper, winter fat, fourwing saltbush and skunkbush sumac.

Cover and water. The irregular topography, variety of exposures and interspersion of browse food plants with juniper provide almost ideal winter cover for deer. Water is not a limiting factor for deer on the winter range within the Horse Range.

Browse studies. The BLM and Montana Fish and Game Department recognized the need for browse studies on the winter range years ago. Montana Fish and Game set up five Cole type browse studies on the crucial range in 1960, and a joint BLM-Montana Fish and Game project resulted in the Sykes Coulee Exclosure, a three-way exclosure completed in 1964. The location of the Sykes Exclosure and the five Cole transects are plotted on the wildlife overlay.

The five Cole browse studies were established in 1960 on key areas of the winter range. All five studies are within the boundaries of the Horse Range and are on the key species, mountain mahogany. Cole studies are designed to provide information on form class or the degree of hedging of plants resulting from animal use, plant age classes which give insight into the degree of plant decadency and

the relative amount of use of the plants by animals. From analysis of these data the condition of the plants will be evident and by comparing results gathered over the years the trend can be determined. The Cole method uses the percentage of available twigs browsed as an index to utilization, and Stickney (Reference # 15) found it generally sensitive up to the 60 percent level of twigs browsed. At higher utilization levels the accuracy declines but the Cole method is sensitive to the range of utilization of major concern to the habitat manager. The major failures of the method are lack of annual production information and since readings are made only in the spring there is no way to evaluate browse use in late summer and fall by species other than deer.

Mr. Arnold Foss, Billings District Game Manager, Montana Fish and Game, provided a summary of these transects since 1960. (See Appendix #5) These studies show a slight decrease in the number of severely hedged plants from 1960 to 1968 with a slight decrease in the percentage of plants classed as decadent. The most striking results of the studies were the gradual and fairly regular decline of use of mahogany from 1960 to 1968. Average leader use declined from about 75% in the early 1960's to about 20% in 1967 and 1968. The decrease in utilization is directly correlated with changes in the deer population which are discussed later in this report.

The Sykes Coulee exclosure established in 1964 consists of two fenced plots and one unfenced plot. One fenced plot excludes all plant-eating mammals except rabbits and rodents. The adjacent fenced plot is closed to livestock and horses and open to deer, and the third plot open to all classes of animals. Mountain mahogany inside the total protection and deer only fenced plots shows very little apparent difference from plants in the unfenced plot. The vigor of the browse plants was very low at the time the exclosure was constructed and some individual plants are now showing good annual growth for the first time since the study was established. The exclosure was located on the lower edge and hence lower moisture portion of the mahogany zone and probably will show slower recovery than plants at higher elevations. Deer use in the general area of the exclosure has been very light the past two years.

In summary, the current browse range condition is fair to poor and the trend is up. Most of the mountain mahogany on the crucial areas is in severely hedged condition with many dead or partially dead plants showing evidence of past heavy use. The hedged plants are showing some recovery, and there is limited mahogany reproduction on parts of the range. Some of the mahogany in the southern portion of Dryhead Road exhibits the characteristic smooth rounded hedging caused by cows, and most other mahogany plants show effects of past

heavy use (club type hedging) by deer. Mahogany plants growing on sites inaccessible to deer or cattle show no hedging and good vigor and provide a good basis for comparison with browsed plants.

The recovery of the mahogany plants is slow; this is not unexpected considering the previous excessive use and resultant low vigor. The much lower utilization by deer during the past few years is primarily responsible for the upward trend of the mahogany. A useful indicator of current utilization is the amount of deer use on relatively unpalatable browse species. Skunkbush sumac, a relatively unpalatable deer food plant, occurs on the Horse Range in small amounts and has not been used to any degree in recent years. During periods of high deer numbers when palatable browse species are overutilized, some unpalatable species occurring in low density generally receive at least moderate use. (Reference #17)

Population Dynamics

1. Harvest. The history of the Pryor Mountain deer herd has been fairly typical of most Montana deer herds, that is, increasing beyond the winter range capacity and reaching a population peak in the late 1940's or early 1950's. The condition of the winter range and history of hunting seasons of the Pryor Mountain herd generally show this was the pattern in the Pryors.

Hunting on this Unit was restricted to buck only with a one-deer limit until 1953 when an either-sex regulation was established. Buck-only hunts were discontinued entirely in 1956, and in 1958 a two-deer, either-sex limit imposed as well as a late season. (See Appendix 6.) Two-deer, either-sex hunts with special late seasons and 200 special non-resident licenses are still in effect. These special efforts to harvest deer all point to a recognition by Montana Fish and Game Department of an overpopulation and an attempt to solve the problem. The herd now appears to be close to the level of winter range carrying capacity. Up to a point the lower the herd the faster the depleted winter range can recover.

Hunter harvest statistics for the Pryor Mountain herd unit are included in Appendix 7. Since 1959 about 600 hunters harvested some 500 deer each year on this unit. It is interesting to note that success by resident hunters has gradually dropped from a high of 122 percent success in 1957 to 63 percent success in 1967.

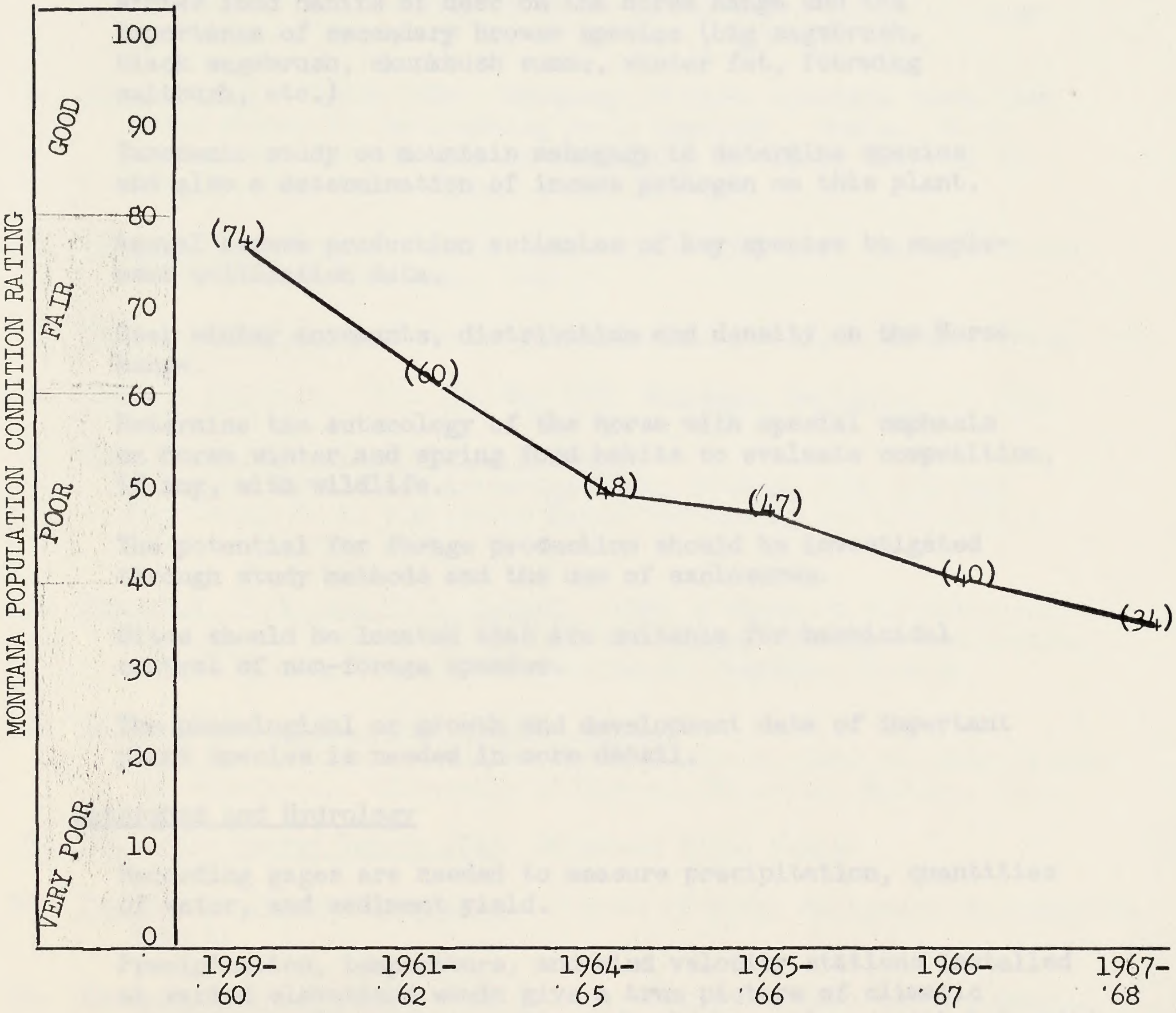
Hunter success exceeded 100 percent in some years because hunters could legally take two deer. If we assume the effort by the resident hunter has remained approximately the same from year to year, the generally more selective resident hunter has found deer hunting on the Pryors less productive. The kill has been maintained by the less selective and at times harder hunting non-resident hunter. These data probably mean the deer population is considerably lower now than ten years ago.

2. Productivity. On the productivity end of the scale it has been shown that deer on poor range have a lower rate of reproduction than those on ranges with an adequate supply of highly nutritious plants (References #1 and 16). The objective of sound deer management, then, is to keep fewer females on moderately used ranges and have higher annual production per female with substantially less chance of damaging the range. Overstocked ranges produce smaller amounts and less nutritious forage than light or moderately stocked ranges. McCain and Taylor (Reference #17) state an axiom of deer management, "A poor rate of increase (fawn survival) is the game manager's cue to look for trouble." This statement generally summarizes productivity of this herd and the efforts by Montana Fish and Game to balance herd and forage. The very poor productivity of this herd is almost certainly due to poor range conditions.

Winter deer sex and age classifications (Appendix 8) are made in winter by personnel of the Montana Fish and Game Department. A summary of these data for the past six classifications shows graphically the herd's productivity.

WINTER DEER CLASSIFICATIONS - PRYOR MOUNTAIN AREA

FAWNS : 100 DOES



The declining productivity and fairly constant harvest has resulted in a smaller herd and has permitted the winter range to start a slow recovery.

Needs for Additional Data

Range and Wildlife

Winter food habits of deer on the Horse Range and the importance of secondary browse species (big sagebrush, black sagebrush, skunkbush sumac, winter fat, fourwing saltbush, etc.)

Taxonomic study on mountain mahogany to determine species and also a determination of insect pathogen on this plant.

Annual browse production estimates of key species to supplement utilization data.

Deer winter movements, distribution and density on the Horse Range.

Determine the autecology of the horse with special emphasis on horse winter and spring food habits to evaluate competition, if any, with wildlife.

The potential for forage production should be investigated through study methods and the use of exclosures.

Sites should be located that are suitable for herbicidal control of non-forage species.

The phenological or growth and development data of important plant species is needed in more detail.

Watershed and Hydrology

Recording gages are needed to measure precipitation, quantities of water, and sediment yield.

Precipitation, temperature, and wind velocity stations installed at varied elevations would give a true picture of climatic conditions. The higher stations should be equipped with telemetric recorders that can be operated by remote control.

One surface water and sediment sampling station on Big Coulee at the south edge of the Horse Range should be sufficient to determine runoff and yield.

Although all of the above data and information would be useful, the lack of it should not delay the initiation of a grazing system that will allow periodic rest to the resource and the vegetation.

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Table of Precipitation at Stations Surrounding Pryor Mountain Wild Horse Range 1/

	Lovell, Wyo.	Deaver, Wyo.	Bridger, Mont.	Pryor, Mont.	Camp No. 4, Mont.	Yellowtail Dam, Mont.
Location (miles-direction from SW cor. Custer N. F.)	18 - S	19 - SW	31 - WNW	26 - NNW	31 - NE	25 - ENE
Elev. (ft. above sea level)	3835	4105	3680	4000	3650	3292
Period of Record (years)	19	19	20	17	13 2/	5 3/
Mean Annual Precipitation (inches)	6.35	5.28	10.72	14.81	13.86	20.30
May-Sept. Mean Annual Precipitation (inches)-- (percent of total)------	4.23 64	3.83 73	6.32 59	8.24 56	8.01 58	10.98 54

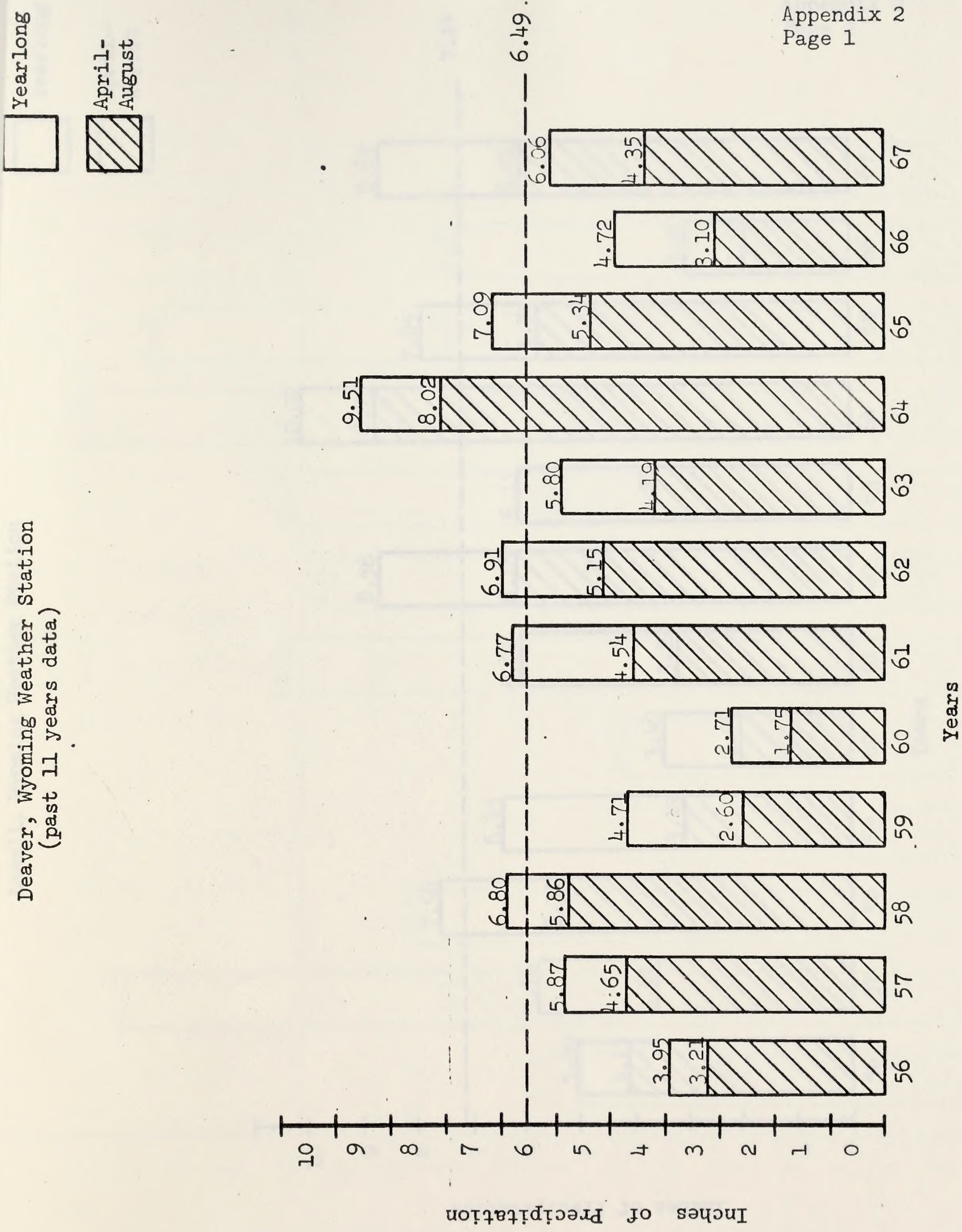
The first four stations averaged 117% above the long-time precipitation mean from 1961 through 1967. Only 1966 was less than average, being 76% of the mean.

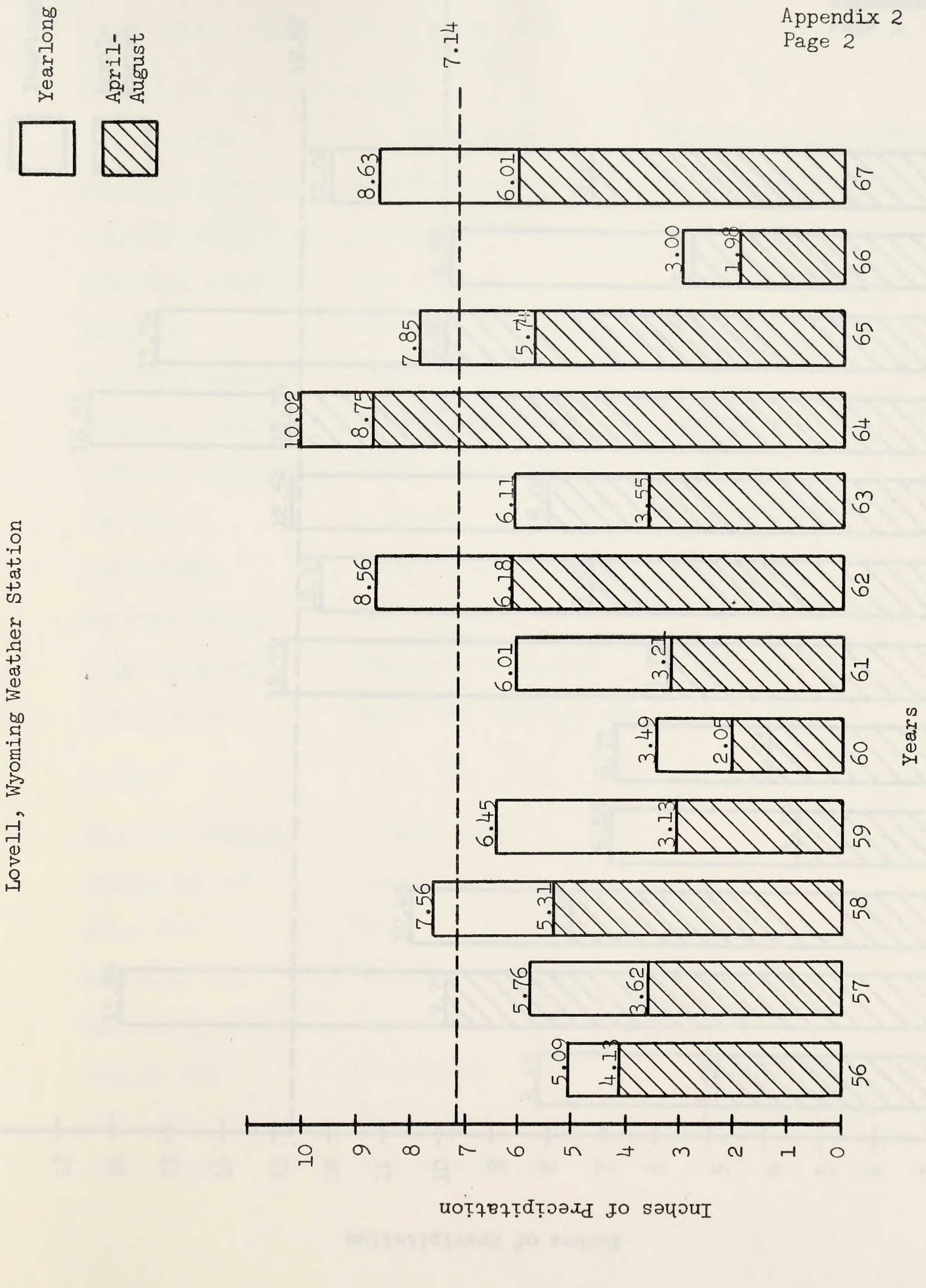
Precipitation for January through August 1968 at Lovell, Deaver, and Bridger averaged 141% above the long-time precipitation mean for these months.

Tillett Fish Rearing Station unofficial records have averaged 10.0" for 3 years. The projected mean is about 8", based on records of the other stations during this period.

Precipitation generally has been above average for the past 7 years at the recording stations. It may be assumed this would also be the case within the Horse Range.

1/ Climatological Data, Annual Summaries 1948-1967. U. S. Weather Bureau.
2/ Closed January 1961.
3/ Established December, 1962.


Deaver, Wyoming Weather Station
(past 11 years data)


Lovell, Wyoming Weather Station
Yearlong
April-August
7.14
Inches of Precipitation
0
1
2
3
4
5
6
7
8
9
10
Years
56
5.09
4.13
57
5.76
3.62
58
7.56
5.31
59
6.45
3.13
60
3.49
2.05
61
6.01
3.21
62
8.56
6.18
63
6.11
3.55
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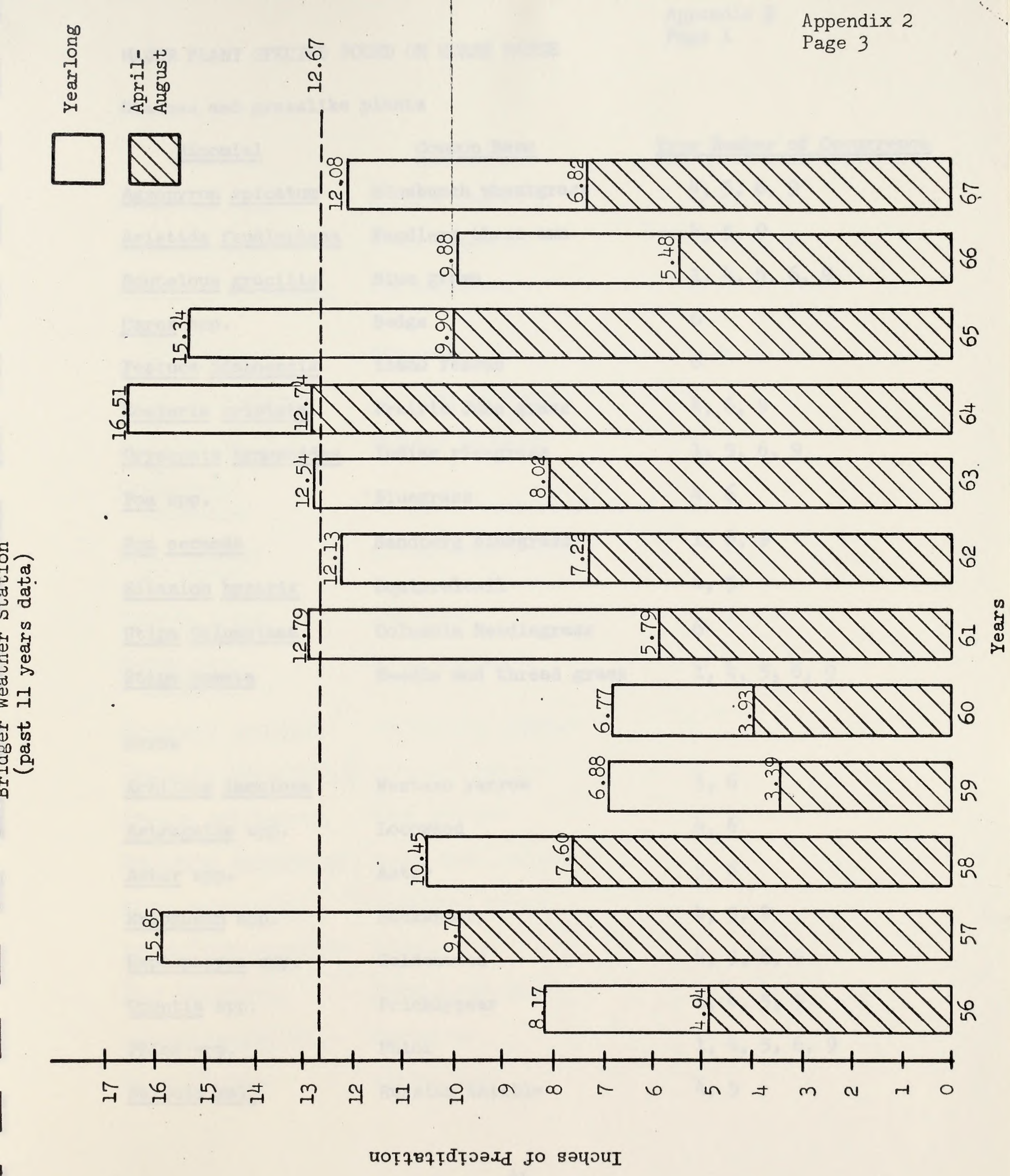
10.02
8.75
65
7.85
5.74
66
3.00
1.98
67
8.63
6.01


Bridger Weather Station
(past 11 years data)
Yearlong
April-August
12.67
67
12.08
6.82
66
9.88
5.48
65
15.34
9.90
64
16.51
12.74
63
12.54
8.02
62
12.13
7.22
61
12.79
5.79
60
6.77
3.93
59
6.88
3.39
58
10.45
7.60
57
15.85
9.79
56
8.17
4.94
Years
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Inches of Precipitation

MAJOR PLANT SPECIES FOUND ON HORSE RANGE

Grasses and grasslike plants

Binomial	Common Name	Type Number of Occurrence
Agropyron spicatum	Bluebunch wheatgrass	4, 5, 6, 9
Aristida fendleriana	Fendlers three-awn	4, 5, 9
Bouteloua gracilis	Blue grama	1, 4, 5, 6, 9
Carex spp.	Sedge	6
Festuca idahoensis	Idaho fescue	6
Koeleria cristata	Prairie June grass	4, 6, 9
Oryzopsis hymenoides	Indian ricegrass	1, 5, 6, 9
Poa spp.	Bluegrass	4, 6
Poa secunda	Sandberg bluegrass	1, 6, 9
Sitanion hystrix	Squirreltail	4, 5
Stipa Columbiana	Columbia Needlegrass	6
Stipa comata	Needle and thread grass	1, 4, 5, 6, 9

Forbs

Binomial	Common Name	Type Number of Occurrence
Achillea lanulosa	Western yarrow	5, 6
Astragalus spp.	Locoweed	4, 6
Aster spp.	Aster	5, 6
Eriogonum spp.	Buckwheat	4, 5, 9
Haplopappus spp.	Goldenweed	4, 5, 6, 9
Opuntia spp.	Pricklypear	1, 4, 5, 9
Phlox spp.	Phlox	1, 4, 5, 6, 9
Salsola kali	Russian thistle	4, 5

Shrubs and trees

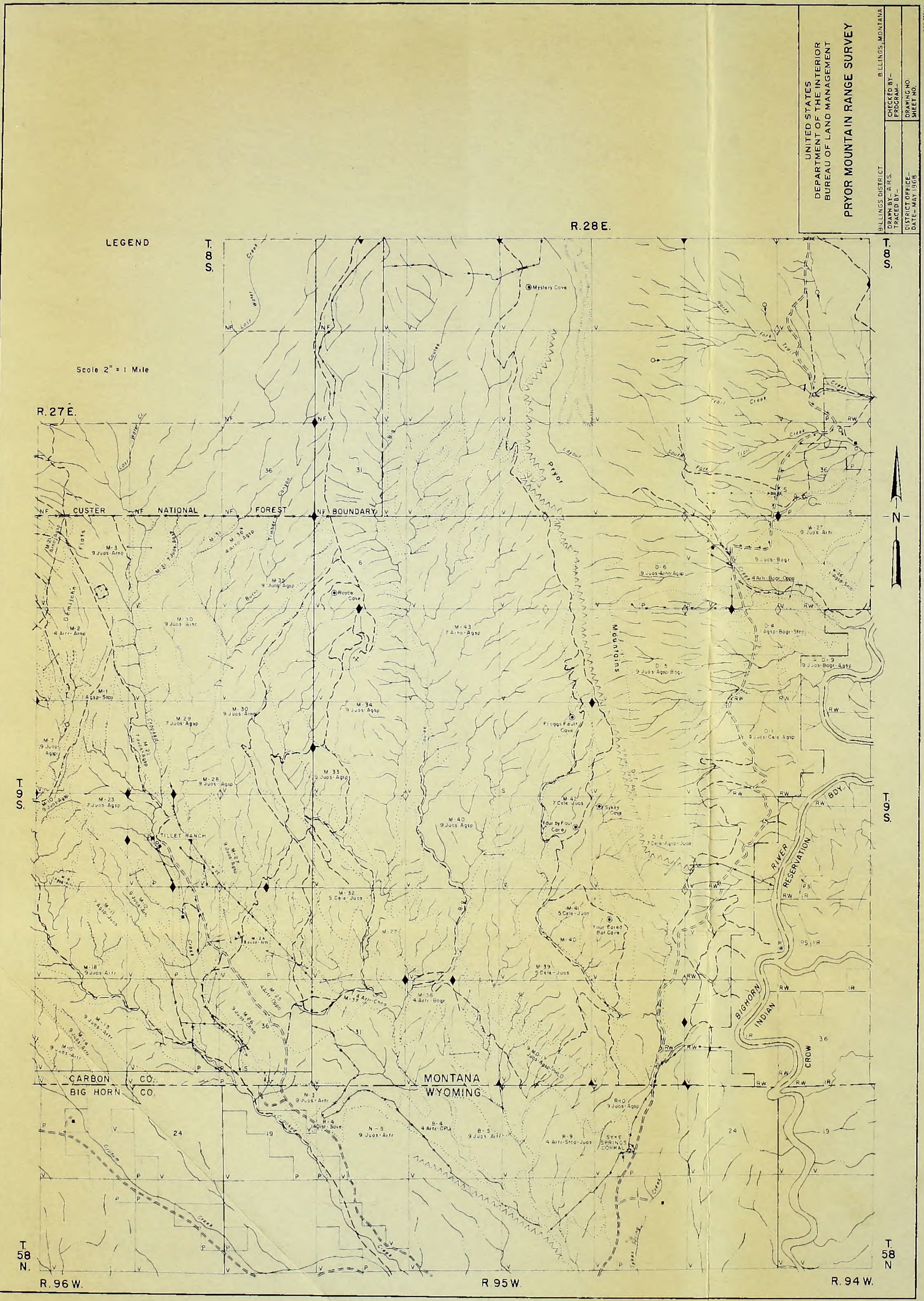
Binomial	Common Name	Type Number of Occurrence
Artemisia frigida	Fringed sagewort	1, 5, 6
Artemisia nova	Black sagebrush	4, 5, 6, 9
Artemisia tridentata	Big sagebrush	1, 4, 5, 6, 9
Atriplex confertifolia	Shadscale	1, 4, 5, 9
Atriplex canescens	Fourwing saltbush	9
Atriplex nuttallii	Nuttals saltbush	4, 9
Cercocarpus ledifolius	Curlleaf mountain mahogany	5, 9
Chrysothamnus nauseosus	Rubber rabbitbrush	1, 4, 9
Eurotia lanata	Winterfat	6, 9
Gutierrezia sarothrae	Broom snakeweed	1, 4, 5, 9
Juniperus communis	Common mtn. juniper	6
Juniperus horizontalis	Creeping juniper	6
Juniper osteosperma	Utah juniper	1, 4, 5, 6, 9
Juniperus scopulorum	Rocky Mtn. juniper	6
Picea engelmannii	Engelmann spruce	6
Pseudotsuga menziesii	Douglas fir	7
Rhus trilobata	Skunk brush sumac	5, 9
Symphoricarpos spp.	Snowberry	4, 9
Pinus flexilus	Limber pine	6

LEGEND

Type #	Type Name	Map Symbol	Common Name
1	Grass	1 Agsp-Bogr-Stco	Bluebunch wheatgrass Blue grama grass Needle-and-thread grass
4	Sagebrush	4 Arno-Agsp	Black sagebrush Bluebunch wheatgrass
		4 Artr-Bogr	Big sage, Blue grama grass
		4 Artr-Chna	Big sage, Rabbitbrush
		4 Artr-OPU	Big sage, Pricklypear
		4 Artr-Stco-Juos	Big sage, Needle-and-thread grass, Juniper
5	Mtn. Shrub	5 Cele-Juos	Mountain mahogany, Juniper,
		5 Cele-Agsp-Juos	Mountain mahogany, Bluebunch wheatgrass, Juniper
		5 Juos-Cele-Agsp	Juniper, Mountain mahogany, Bluebunch wheatgrass
6	Conifer	6 Psme-Juos-Agsp	Douglas-fir, Juniper, Bluebunch wheatgrass
		6 Psme-Juco	Douglas-fir, Common mountain juniper
9	Juniper	9 Juos-Agsp-Bogr	Juniper, Bluebunch wheatgrass, Blue grama grass
		9 Juos-Agsp	Juniper, Bluebunch wheatgrass
		9 Juos-Arno	Juniper, Black sage

Type #7 which is considered unusable by livestock has been omitted due to lack of knowledge concerning its applicability to horses.

Under "Map Symbol" the first plant abbreviation identifies the dominant plant in the type. For example, under No. 1 Agsp, this plant, bluebunch wheatgrass, is the dominant grass in the type. The following plant initials identify other important plants in the type. The complete plant list is included in each survey write-up sheet. For example, there may be 20 to 30 individual plants identified and recorded as to quantity and other factors on the write-up sheet. These do not appear in the type designations.



UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

PRYOR MOUNTAIN RANGE SURVEY

BILLINGS DISTRICT
BILLINGS, MONTANA
DRAWN BY– A.R.S.
TRACED BY–
CHECKED BY–
PROGRAM–
DISTRICT OFFICE–
DATE– MAY 1968
DRAWING NO.
SHEET NO.

Condition, Trend and Utilization Data for *Cercocarpus ledifolius* from Five Study Plots Located on the Pryor Mountain Deer Winter Range[1]

Plot	Year	Form Class 3 & 6	Age Class % Mature	Age Class % Decadent	Avg. Crown Area Dead %	Leader Use Avg. %
468 (50 plants on each)	1960	88	4	96	54	86
	1961	90	29	58	No data	9
	1962	98	18	80	52	85
	1963	100	8	92	46	50
	1964	94	6	90	54	56
	1965	82	8	74	42	27
	1966	46	16	72	38	29
	1967	58	4	96	56	29
	1968	72	26	74	44	41
470 (50 plants on each)	1960	92	2	98	61	78
	1962	100	16	82	54	85
	1963	96	10	86	50	36
	1964	100	8	86	56	74
	1965	86	6	82	50	48
	1966	88	14	82	52	55
	1967	84	10	90	54	25
	1968	88	16	84	47	27
471 (50 plants on each)	1960	82	20	78	40	77
	1963	100	14	86	42	23
	1964	98	2	96	53	26
	1965	90	4	92	55	27
	1966	78	8	90	49	40
	1967	82	18	82	39	13
	1968	84	14	86	43	10
472 (50 plants on each)	1960	86	6	94	39	60
	1961	92	18	80	No data	7
	1962	98	14	86	45	85
	1963	92	32	68	37	18
	1964	78	28	66	37	23
	1965	50	32	66	39	14
	1966	54	32	66	37	28
	1967	64	34	66	37	24
	1968	62	34	66	38	10
473 (50 plants on each)	1960	98	16	84	43	73
	1961	98	30	70	No data	33
	1962	100	14	86	52	82
	1963	98	26	74	47	40
	1964	92	18	82	52	37
	1965	78	18	82	47	33
	1966	40	40	54	30	32
	1967	64	20	80	47	13
	1968	48	36	62	35	4

[1] Form class refers to the degree of hedging resulting from animal use of the plant. Form classes 3 and 6 indicate severely hedged plants. Age class reflects the degree of decadency in plant crown. Plants are considered mature if less than 25% of the crown area is decadent. Range ratings are assigned on the basis of the number of plants in the severely hedged condition; less than 10% severely hedged rates excellent, 11-20% good, 21-30% fair, 31-50 poor, 50 plus very poor. Each plot includes a sample of 50 plants.

Summary of Average Condition, Trend and Utilization for Cercocarpus ledifolius from Five Study Plots Located on the Pryor Mountain Deer Winter Range

Year	% Form Class 3 & 6	Age Class		Avg. % Crown Area Dead	Leader Use Avg. %
		% Mature	% Decadent		
1960	89	10	90	47	75
1961	93	26	69	No data	16
1962	99	16	84	51	84
1963	97	18	81	44	33
1964	92	12	84	50	43
1965	77	14	79	47	30
1966	61	22	73	41	37
1967	70	17	83	47	21
1968	71	25	74	41	18

HISTORY OF HUNTING SEASONS IN PRYOR MOUNTAIN AREA, 1952-1968

Year	Season Length		Type of Season and Bag Limit
1952	Nov. 1 - Nov. 15	(Carbon County)	Bucks - 1 deer
	Oct. 15 - Oct. 21	(Bighorn County)	Bucks - 1 deer
1953	Oct. 15 - Oct. 26		Bucks - 1 deer
	Oct. 15 - Oct. 17		E. S. - 1 deer
1954	Oct. 15 - Oct. 31		Bucks - 1 deer
1955	Oct. 15 - Nov. 15		Bucks - 1 deer
	Oct. 1 - Oct. 14	(Archery)	E. S. - 1 deer
1956	Oct. 15 - Nov. 15		E. S. - 1 deer
1957	Oct. 20 - Nov. 20		E. S. - 1 deer
1958	Oct. 19 - Nov. 2		E. S. - 2 deer
	Nov. 3 - Nov. 23		E. S. - 1 deer
1959	Oct. 18 - Nov. 22	(Special NR licenses available)[1]	E. S. - 2 deer
1960	Oct. 16 - Nov. 20	(Special NR licenses available)	E. S. - 2 deer
1961	Oct. 15 - Nov. 19	(Special NR licenses available)	E. S. - 2 deer
1962	Oct. 21 - Nov. 25	(Special NR licenses available)	E. S. - 2 deer
1963	Oct. 20 - Nov. 24	(200 special NR licenses available)	E. S. - 2 deer
1964	Oct. 18 - Nov. 22	(200 special NR licenses available)	E. S. - 2 deer
1965	Oct. 24 - Nov. 28	(200 special NR licenses available)	E. S. - 2 deer
1966	Oct. 23 - Nov. 13	(200 special NR licenses available)	E. S. - 2 deer
	Dec. 11 - Dec. 24		
1967	Oct. 22 - Nov. 19	(200 special NR licenses available)	E. S. - 2 deer
	Dec. 10 - Dec. 24		
1968	Oct. 27 - Dec. 1	(200 special NR licenses available)	E. S. - 2 deer
	Dec. 15 - Dec. 29		

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[1] Special nonresident license allows hunter to take one deer during the specified season; the bag limit indicated pertains to the resident hunter and the non-resident with a full complement license.

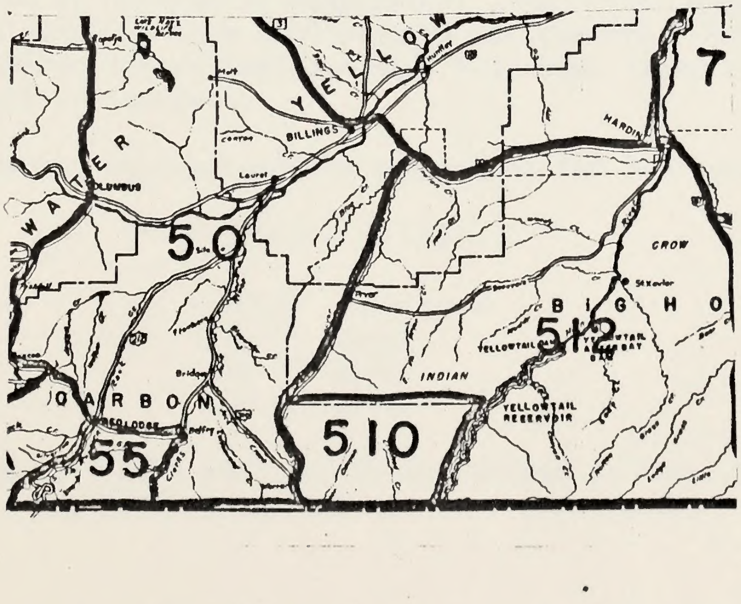
1968 Deer, Elk and Bear Hunting Regulations

MONTANA FISH AND GAME DEPARTMENT—Helena, Mont.

DEER REGULATIONS

FOR HOLDERS OF RESIDENT LICENSES AND NONRESIDENT $150.00 BIRD, BIG GAME AND FISHING LICENSES.

HUNTING DISTRICT	OPENS	CLOSES	"A" TAG Good for Mule Or Whitetailed Deer	"A" TAG Good For Whitetailed Deer Only	"B" TAG Good For Mule Or Whitetailed Deer	"B" TAG Good for Whitetailed Deer Only	"B" TAG Not Valid In This Hunting District	Nonresident Deer Hunter Must Be Accompanied By Resident Licensed To Hunt Game	SPECIAL REGULATIONS
510	Oct. 27	Dec. 1	X		X				
	Dec. 15	Dec. 29	X		X				
511	Oct. 27	Dec. 1	X		X				
512	Oct. 27	Dec. 1	X		X				
60	Oct. 27	Nov. 3	X			X		X	
	Nov. 4	Dec. 1		X		X		X	
61	Oct. 27	Dec. 1	X			X			



510 PRYOR MOUNTAINS: Those portions of Carbon and Big Horn Counties lying within the following described boundary: Beginning at a point where U. S. Highway 310 crosses the Wyoming State Line, thence northerly along said highway to Warren, thence northerly along the Warren-Pryor Road to the Carbon County-Big Horn County Line, thence easterly along said county line to the Big Horn River, thence east across the Big Horn River to the Bureau of Reclamation Take-line at the 3,675-foot Contour Line in the Big Horn Canyon, thence southeasterly along said contour line in the Big Horn Canyon to the Wyoming State Line, thence westerly along the Wyoming State Line to the point of beginning.

HUNTER HARVEST STATISTICS FROM MAIL QUESTIONNAIRE SURVEYS FOR THE PRYOR MOUNTAINS AREA[1]

Year[2]	Number Hunters[3]				Harvest				Hunter Success			
	R	RNR	SNR	T	R	RNR	SNR	T	R	RNR	SNR	Avg.
1959	464	0	12	476	565	0	12	577	122	0	100	122
1960	696	19	22	737	753	12	22	787	108	67	100	107
1965	409	0	175	584	309	0	138	446	76	0	79	77
1966	508	8	181	697	395	16	150	561	78	200	83	81
1967	380	0	200	580	240	0	163	403	63	0	82	70

[1] The area is enclosed by the Wyoming line on the south, the Warren-Pryor Road on the west, Big Horn-Carbon County line on the north, the Big Horn River on the east.

[2] Data for years 1961 through 1964 not included; the Pryor Mountain area was included with another hunting area during this time.

[3] R = resident hunter, RNR = nonresident hunter with full complement license equivalent to resident, SNR = special nonresident license allowing hunter one deer in Pryor area only.

WINTER DEER CLASSIFICATIONS FROM THE PRYOR MOUNTAIN AREA*

Year	Bucks	Does	Fawns	Total	Fawns/100[1] Does	Fawns/100 Adults	Bucks/100 Does
1967-68[2]	46	345	116	507	34	30	13
1966-67	97	250	101	448	40	29	39
1965-66	12	51	24	87	47	38	24
1964-65	51	117	56	224	48	33	44
1961-62	16	70	42	128	60	49	23
1959-60	22	58	43	123	74	54	38

[1] A summer study relating to mule deer-livestock range use and deer population dynamics in the Pryor Mountains gave age ratios of 54 fawns/100 does and 32 fawns/100 does for 1967 and 1968, respectively. Sample size was comparable to the figures given for winter of 1967 and 1968.

[2] Aerial classification with helicopter; all other observations made on ground with field glasses and spotting scope.

Age ratios probably most valuable from the fawns/100 doe classification - based on fawn/doe or fawn/adult categories. The ratios show a substantial decline in fawn survival from 1960 through the present. Some of Firebaugh's summer observations indicate that this same trend exists for productivity as well as survival.

Population condition rating based on age ratios for deer are:

(Fawns:100 Does)

20-39	very poor
40-59	poor
60-79	fair
80-99	good

*Data in Appendices (5-8) prepared by Mr. Arnold J. Foss, Billings District Game Manager, Montana Fish and Game Department.

SUMMARY OF PHYSICAL SOIL CHARACTERISTICS OF MAPPING UNITS

Mapping Unit Symbol	Drainage	Value for Water Retaining Structures	Water Holding Capacity (inches per foot)	Slope (percent)	Production Potential	Erosion Susceptibility	Depth to Calcareous Material	Soil Depth (inches)
07	Good	Very poor	1.0 to 1.8	8 to 30	Low	Susceptible		<20
7B	Good	Good	1.0 to 1.8	<6	High	Numerous channels		>36
14B	Good	Fair	1.5 to 2.3	2 to 4	Medium	Susceptible	At surface	>20
14C	Good	Fair	1.5 to 2.3	4 to 8	Medium	Susceptible	At surface	>20
23E	Good	Very poor	1.2 to 2.3	15 to 35	High	Susceptible	More than 5	>30
27B	Poor	Very poor	1.5 to 2.5	2 to 4	Affected by sodium content	Susceptible	Strongly calcareous with high sodium	>36
29C	Good	Very poor	1.0 to 1.8	4 to 8	High	Susceptible	Strongly calcareous	>36
29D	Good	Very poor	1.0 to 1.8	8 to 15	High	Susceptible	Strongly calcareous	>36
31C	Good	Very poor	1.25 to 2.3	4 to 8	Medium	Susceptible	Strongly calcareous	<20
40F	Good	Poor	1.5 to 2.5	35 to 70	Medium	Susceptible	More than 16	38 to 40
84B	Good	Good	1.5 to 2.5	2 to 4	High	Erosive	More than 6	>36
91B	Good	Fair	1.75 to 2.50	2 to 4	High	Susceptible	Strongly calcareous with gypsum crystals at 43 inches	>36
91C	Good	Fair	1.75 to 2.50	4 to 8	High	Susceptible	Strongly calcareous with gypsum crystals at 43 inches	>36
100	Good	Not suitable	Low	>8	Low	Susceptible	At surface	<20

SUMMARY OF PHYSICAL SOIL CHARACTERISTICS OF MAPPING UNITS--Continued

Mapping Unit Symbol	Drainage	Value for Water Retaining Structures	Water Holding Capacity (inches per foot)	Slope (percent)	Production Potential	Erosion Susceptibility	Depth to Calcareous Material	Soil Depth (inches)
184C	Good	Good	1.5 to 2.5	4 to 8	Moderately high	Erosive	More than 6	>36
200	Shale Outcrop Areas			>90	-----	Highly erosive		<10
224F	Good	Fair	.7 to 2.5	15 to 45	Low	Susceptible	Less than 4	<20
300	Sandstone - Rockland			>25	-----	-----		<20
400	Good	Poor	1.25 to 2.3	50 to 90	Low	Highly erosive	More than 4	<20
402	Good	Poor	1.5 to 2.5	15 to 50	Medium	Erosive	More than 4	<20
403	Good	Very poor	1.2 to 2.2	15 to 35	Medium	Susceptible	More than 4	16
404	Good	Fair	1.2 to 2.3	15 to 95	Medium	Very erosive	At surface	<20
500	Limestone - Rockland			>90	-----	-----		<20
584B	Good	Poor	1.5 to 2.5	2 to 6	High	Erosive	More than 6	>36

SOILS INFORMATION
WILD HORSE RANGE
PRYOR MOUNTAINS, MONTANA

The following soils information is based on the recent Soil Survey provided by the Soil Conservation Service. The undersigned has reviewed the original report and reduced its contents as follows without an on-the-ground investigation.

The soils report contains some 24 mapping units which consist of various soil types, associations or land forms. These soil associations and/or land types occur on all degrees of slopes and various geologic formations. The majority of the Wild Horse Range is composed of the mapping units 300 and 500.

The mapping unit 300 Sandstone Rockland type occurs on slopes of 25 to over 90 percent. It consists of steep to very steep ledgy, barren or partially barren hard sandstone cliffs and slopes with small isolated areas of thin sandy soil which occurs in pockets, small swales and on benches. These sandy soils support a sparse vegetative growth of low-growing shrubs and grasses. There are some areas that have huge sandstone boulders that cover 90 to 100 percent of the surface. The small areas of sandy soil are less than 20 inches deep over hard sandstone and do not exceed 5 to 10 acres in size.

The mapping unit 500 Limestone Rockland occurs above or at a higher elevation than the 300 Sandstone Rockland unit. It consists of 85 to 95 percent limestone rock with 5 to 15 percent shallow limey

dark-colored soils. The unit is steep to very steep with most slopes over 90 percent. There are small areas of relatively flat and rounded tabular divides occurring between the steep cliffs and limestone canyons. The unit contains low-growing juniper and shrubs with an occasional pine tree.

The 40F Skaggs-Trapper mollic variant silt loam and channery silt loam mapping unit occurs on strongly sloping to steep footslopes (35 to 70 percent) below the Skaggs variant soil. The latter soil occurs on the steep to very steep talus slopes below the limestone cliffs. It is associated with the 500 Limestone Rockland mapping unit. Numerous sandstone and limestone ridges traverse the unit. The Skaggs variant soil has a gravelly silty clay loam to gravelly clay loam profile 38 to 40 inches deep resting on hard limestone and siltstone. It contains 1 to 4 inches of topsoil covered with a layer 1 to 3 inches of loose partly decomposed evergreen needles and twigs. The subsoil varies from 6 to 10 inches thick and is strongly calcareous or alkaline below 7 to 10 inches. The Trapper mollic variant silt loam and channery silt loam soil of this mapping unit is deeper than the Skaggs. It is at least 60 inches deep. The topsoil ranges from 1 to 4 inches thick and the clay loam subsoil varies from 18 to 24 inches in thickness. The surface soil is covered with a layer of partially decomposed evergreen needles 1 to 4 inches thick. The soil is moderately calcareous below 16 inches. These two soils would erode severely if the tree cover and forest litter were destroyed. They will retain from

1.50 to 2.50 inches of water per foot depth of soil. Natural fertility is moderate.

There are benchlike areas with steep sided drainageways of sandstone and/or limestone cliffs in the unit. Some limestone outcrops occur, and rocks below the limestone cliffs cover 50 percent of the ground surface. This unit has a 90 to 100 percent tree crown cover (fir).

The mapping unit 100 Lap Association consists of channery (fragments of thin, flat sandstone or limestone) and stony soils developing from limestone, siltstone and red colored rocks on strongly sloping (8 to 15 percent) to steep mountain slopes. It is associated mainly with mapping units 40F Skaggs-Trapper and 500 Limestone Rockland. The landscape consists of rounded ridges that form narrow divides between canyons cut into the limestone bedrock. The unit generally occupies these rounded ridges. Slopes are usually smooth. The Lap soil consists of a loam, silt loam, or channery loam topsoil 2 to 6 inches thick over a subsoil of the same type textural characteristics. It is a very shallow calcareous soil that varies in depth from 10 to 20 inches over limestone bedrock.

The soils of this mapping unit are well drained and permeable. Runoff is rapid. Available water holding capacity is low and they are of a droughty nature. Natural fertility is moderate. This mapping unit is not suitable for seeding due to its very shallow, rocky, and droughty characteristics.

The 400 Redshale and Abac soils complex mapping unit consists of steep to very steep (50 to 90 percent slopes) and vertical red cliffs that emerge into smooth rounded anticlines. The unit is characterized by its brilliant reddish brown color and the vertical red cliffs of barren shale. It consists of 95 to 100 percent red sandstone and barren shale with 0 to 5 percent Abac and other soils occupying the smooth small benches and stream terraces.

The Abac soil may have a loam, silt loam, fine sandy loam or channery loam texture. The topsoil varies from 2 to 6 inches in depth with a channery loam subsurface layer 10 to 14 inches thick over hard sandstone. The soil is calcareous below 4 to 6 inches. It is well-drained with good permeability. Natural fertility is low and so is the organic matter content. Runoff is rapid. Water holding capacity varies from 1.25 to 2.30 inches per foot depth of soil. This unit is highly erosive. Vegetation is very sparse.

The 402 Abac-Relan variant complex mapping unit occurs on very steep and hilly upland slopes of 15 to 50 percent with sandstone outcrops. The Abac soil is shallow, not over 20 inches deep, and has a silt loam to a channery loam texture. This soil is dominant in the unit. The Relan variant complex soil varies from a medium to a moderately heavy texture in the surface with some gravel. The topsoil varies in thickness from 6 to 14 inches over a subsurface layer of gravelly loam 18 to 26 inches deep. Loose sandstone and shale fragments occur at approximately 32 inches. These soils are strongly calcareous in

their subsurface layers. They are well drained, water infiltration and percolation is good, but they are erosive. Natural fertility is high. Water holding capacity varies from 1.50 to 2.50 inches per foot depth of soil.

The 403 Abac stony loam mapping unit occurs on strongly sloping to steep hilly upland footslopes of 15 to 35 percent. It is similar to the previous mapping unit but is stony in nature. The Abac soils occupy smooth short mid-length footslopes and fan terraces. The unit consists of 85 to 95 percent Abac stony loam with 15 percent or less of Relan variant and other soils which occur in irregular shapes of less than 5 acres in size. Less than 5 percent shale and/or sandstone outcrops occur in the unit. The soils are shallow (approx. 16 inches deep), well drained and permeable to the movement of water and air. Natural fertility and organic matter content is high. Runoff is low. Available water holding capacity varies from 1.2 to 2.2 inches per foot depth of soil. These soils are susceptible to water erosion.

404 Abac-Judith loams and clay loams, 15 to 95 percent slopes

This mapping unit consists of a shallow reddish brown Abac loam soil and a deep gravelly clay loam Judith soil on steep to very steep and hilly topography. The Abac soils occupy the steep areas below the terrace remnants. These soils are well drained, permeable to water and air, high in organic matter content and natural fertility. Available water holding capacity varies from 1.2 to 2.3 inches of water per foot depth of soil. This unit is very erosive.

200 Shale outcrop over 90 percent slopes

This unit consists of nearly barren shale with very steep escarpments and buttes. The exposed stratified shale beds consist of clay, silt and hard sandstone layers. Texture is highly variable depending on which lense of shale is exposed, it will vary from fine to moderately fine to coarse. The unit is essentially devoid of vegetation and, therefore, highly erosive. The shale outcrop areas that are steep are usually capped with hard sandstone.

224F Midway and Travessilla soils - Rocky Association, 15 to 45 percent slopes

This mapping unit consists of Midway clay loam and Travessilla channery (rocky) loam on steep to hilly uplands. The Midway soil occurs on the short and mid-length footslopes and drainage sides. The Midway soil is clayey and shallow, 20 inches or less in depth, over shale. The surface soil varies from clay loam to light clay and 2 to 4 inches thick over a subsurface clayey layer containing salts and gypsum crystals. The subsurface layer varies between 10 and 14 inches in thickness.

The Travessilla soil is shallow, 20 inches or less in depth, over shale and/or sandstone. The surface soil varies from loam to sandy loam and is 2 to 6 inches in thickness. The subsurface layer may have a sandy or medium texture with rocky material present. It is calcareous at 6 to 8 inches. Depth to weathered materials ranges from 3 to 10 inches with hard sandstone present at 12 to 20 inches.

Soils in this unit are well drained and range from rapid to slow permeability. Natural fertility is moderate to low. Available water holding capacity ranges from 0.7 to 2.5 inches per foot of soil depth. They are susceptible to water erosion.

All mapping units discussed thus far are not adapted to land treatment practices such as seeding due to the topographical features, physical soil characteristics which include water retention capacity, rocky nature and depth.

The following mapping units are adaptable for at least limited treatment practices unless otherwise stated. That is, seeding may be applicable if it is deemed necessary to apply this practice. Climate may be the deciding factor of whether a practice is carried out. This factor would play a vital role on whether to recommend a seeding practice.

84B Shorey loam, 2 to 4 percent slopes and 184C Shorey gravelly clay loam, 4 to 8 percent slopes

These two mapping units contain soils of a similar character. They differ only by 184C having gravel in the soil and occurring on steeper slopes. The Shorey soil has a surface layer 2 to 4 inches thick and varying in texture from a heavy loam to a gravelly clay loam. The subsurface layer is silty clay loam with good structure in the upper portion. Calcareous soil material is reached at 6 to 8 inches and increases with depth. The soil is deep - up to 60 inches in depth - with gravel becoming more prevalent at 36 inches and below.

The 84B occupies the gently sloping fan terraces, stream terraces, and old high terraces while the 184C occurs on the strongly sloping terraces, fans and footslopes. The units consist of 85 to 95 percent Shorey soils with 5 to 15 percent other soils. At the change in slopes or similar to the terrace edges, cobbly and stony soils occur.

Soils of these units are well drained and permeable to the movement of water, air and roots. Natural fertility is moderately high with low organic matter content. The available water holding capacity is 1.5 to 2.5 inches per foot of soil depth. These soils are susceptible to water and wind erosion. Runoff is slow to moderate. Water does not penetrate the soil very deeply.

584B Shorey gravelly and stony loam, 2 to 6 percent slopes

This mapping unit consists of Shorey gravelly and stony loam on gently rolling to undulating fans, terraces and footslopes. The unit differs from 84B mainly in having a large quantity of stones through the soil. Soils of this unit have similar soil qualities as those of Mapping Unit 84B. The stones present in this unit could be detrimental for a seeding practice.

07 Reve Stony loam, 8 to 30 percent slopes

This mapping unit consists of Reve stony loam on strongly sloping to steep and hilly alpine, wind-swept rocky grasslands above timberline. The Reve soil is shallow with a dark colored stony loam surface soil 3 to 7 inches thick over a subsurface layer of fine sandy loam 11 to

14 inches in thickness. Depth to sandstone bedrock varies from 14 to 17 inches. The mapping unit is usually covered with snow 8 months out of each year. The Reve soil comprises 85 to 90 percent of the unit with the remaining 10 to 15 percent consisting of other soil types.

Soils of this mapping unit are well drained, permeable and high in natural fertility and organic matter. Runoff is high with slight erosion. Available water holding capacity is 1.0 to 1.8 inches of water per foot depth of soil. This unit is not adaptable to any mechanical land treatment practice.

7B Alluvial land stony and cobbly, 0 to 6 percent slopes

This mapping unit consists of gravelly silt loam and stony and cobbly loam. It occurs on nearly level to strongly sloping drainage ways 100 to 1000 feet wide. The unit is of recent deposition and is generally too stony or cobbly for seeding practices. The drainage channels are usually 2 to 8 feet wide and 4 to 8 feet deep. Juniper trees are common where the unit extends back toward the mountains.

Soils in this unit are well drained and permeable. Natural fertility is moderately high with low organic matter. Available water holding capacity is 1.0 to 1.8 inches per foot depth of soil.

14B Darre silt loam, 2 to 4 percent slopes and 14C Darre loam, 4 to 8 percent slopes

These mapping units consist of 90 to 95 percent Darre soil with 5 to 10 percent of other soils and occur on the gentle footslopes of the

mountain front and on some drainages. The Darre soil occupies the smoother ridges and basins in open grassland areas with other soils occupying the steeper slopes and areas containing scattered trees. The surface texture of the Darre soil varies from silt loam to loam. Depth of the topsoil is approximately 4 inches with the subsurface layer having the same texture and 16 to 20 inches or more deep. The entire soil is calcareous.

Soils of these two mapping units are well drained, high in natural fertility and organic matter, and permeable to water, air and roots. Water holding capacity varies from 1.5 to 2.3 inches per foot depth of soil. There are a few scattered boulders on the ridges and knolls. The soil is susceptible to water erosion.

23E Utica Cobbly loam, 15 to 35 percent slopes

This mapping unit consists of Utica Cobbly loam soil on steep and hilly fan terraces and footslopes. The unit is 85 to 95 percent Utica soils with 5 to 15 percent other soils. There are some large boulders and stones on the ground surface but will not exceed one percent of ground cover. The surface soil ranges from 1 to 6 inches thick with a loam texture; subsurface layer has a clay loam texture , and calcareous material is encountered at 5 to 12 inches. The soil is 32 to 34 inches deep with gravel increasing in size from the 9 inch soil depth on down. Cobbles, stones, and gravel are estimated to comprise 15 to 60 percent by volume of the soil with 36 percent

less than 3 inches in diameter and 15 percent stones larger than 3 inches in diameter.

Soils of this unit are well drained, permeable to water, air and roots and high in natural fertility. Runoff is rapid due to steep slopes. Organic matter content is moderately high. Available water holding capacity varies from 1.2 to 2.3 inches per foot depth of soil. The cobbles and boulders on the surface could preclude seeding this soil.

27B Hysham clay loam, 2 to 4 percent slopes

This mapping unit consists of Hysham clay loam on gently sloping areas. Hysham soils constitute 85 to 95 percent of the unit with 5 to 15 percent of other soils. The Hysham soil has a loam to clay loam surface layer 2 to 5 inches thick with a clay loam to clay textured subsurface layer 18 to 21 inches thick resting on stratified silts, sand and clay materials. The entire soil is strongly calcareous. Salts and gypsum crystals are found below 10 to 12 inches. This soil contains a high sodium content.

This soil has poor surface drainage and slow permeability. Natural fertility is high, but the high sodium content prohibits the release of nutrients for plant use. This soil seals over and crusts after rain storms. Available water holding capacity varies from 1.5 to 2.5 inches per foot depth of soil. Organic matter content is low. Land treatment practice with a contour furrower might improve this soil by

concentrating water in furrows and leaching the sodium salt to a lower depth and therefore, improving the soil-water-plant relationship.

29C Crago stony and gravelly loam, 4 to 8 percent slopes and 29D Crago stony and gravelly loam, 8 to 15 percent slopes

These mapping units consist of Crago stony and gravelly loam soils with a small amount of other soils and occurs on strongly sloping fans and footslopes. The Crago soils occupy 95 to 100 percent of the units. The surface soil ranges from a very gravelly to a very cobbly and stony loam texture and 2 to 5 inches in thickness. The entire soil to 42 inches has essentially the same texture with the subsurface soil containing an estimated 5 to 35 percent by volume of gravel and stones. The soil is strongly calcareous throughout.

Soils of these units are well drained, permeable to water, air and roots, and moderately high in fertility. The organic matter content below 12 inches is low. The cobbly and stony nature of these soils makes them impractical for mechanical land treatment practices. Available moisture holding capacity varies from 1.0 to 1.8 inches per foot depth of soil.

31C Rentsac channery loam, 4 to 8 percent slopes

This mapping unit consists of a shallow rocky fragmental loam soil on strongly sloping upland divides, ridges, and footslopes. The Rentsac soil comprises 70 to 90 percent of the unit with 10 to 30

percent other soils. These inclusive soils occupy the footslopes and swale positions below and between the shallow, rocky Rentsac soil areas. The slopes contain swales and the footslopes are narrow and short. The drainages are U-shaped and in native vegetation are smooth with slight erosion.

The Rentsac loam soil is shallow with a topsoil ranging from 1 to 7 inches thick. Texture varies from sandy loam to loam. The partially weathered shale subsurface layer varies from 3 to 6 inches in thickness over hard sandstone. Depth of soil and soil material is 16 to 20 inches.

Soils of this unit are shallow, well drained with slow root penetration but rapid water movement through the soil. Natural fertility is moderate with low organic matter. Available water holding capacity varies from 1.25 to 2.3 inches per foot depth of soil. The soil is strongly calcareous throughout. This unit would not be adapted to mechanical treatment.

91B Demijohn silty clay loam, 2 to 4 percent slopes and 91C Demijohn silty clay loam, 4 to 8 percent slopes

These mapping units consist of deep silty clay loam soils on gently to strongly sloping upland footslopes, fan terraces, or stream terraces. The unit contains 85 to 95 percent Demijohn soils with 5 to 15 percent other soils. The Demijohn silty clay loam topsoil ranges from 3 to 8 inches thick. Subsurface layers have a silty clay loam texture which

is strongly calcareous. At 43 inches gypsum crystals become common and continue to be evident down to 62 inches. Also stratification occurs below 43 inches with the lenses ranging between 1/2 and 3/4 of an inch thick.

Soils of these units are well drained, permeable to water, air and roots, and low in organic matter. Natural fertility is moderate. Available water holding capacity varies from 1.75 to 2.50 inches per foot depth of soil. These soils are adapted to mechanical treatment.

Lyle D. Linnell

Lyle D. Linnell
Soil Scientist

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

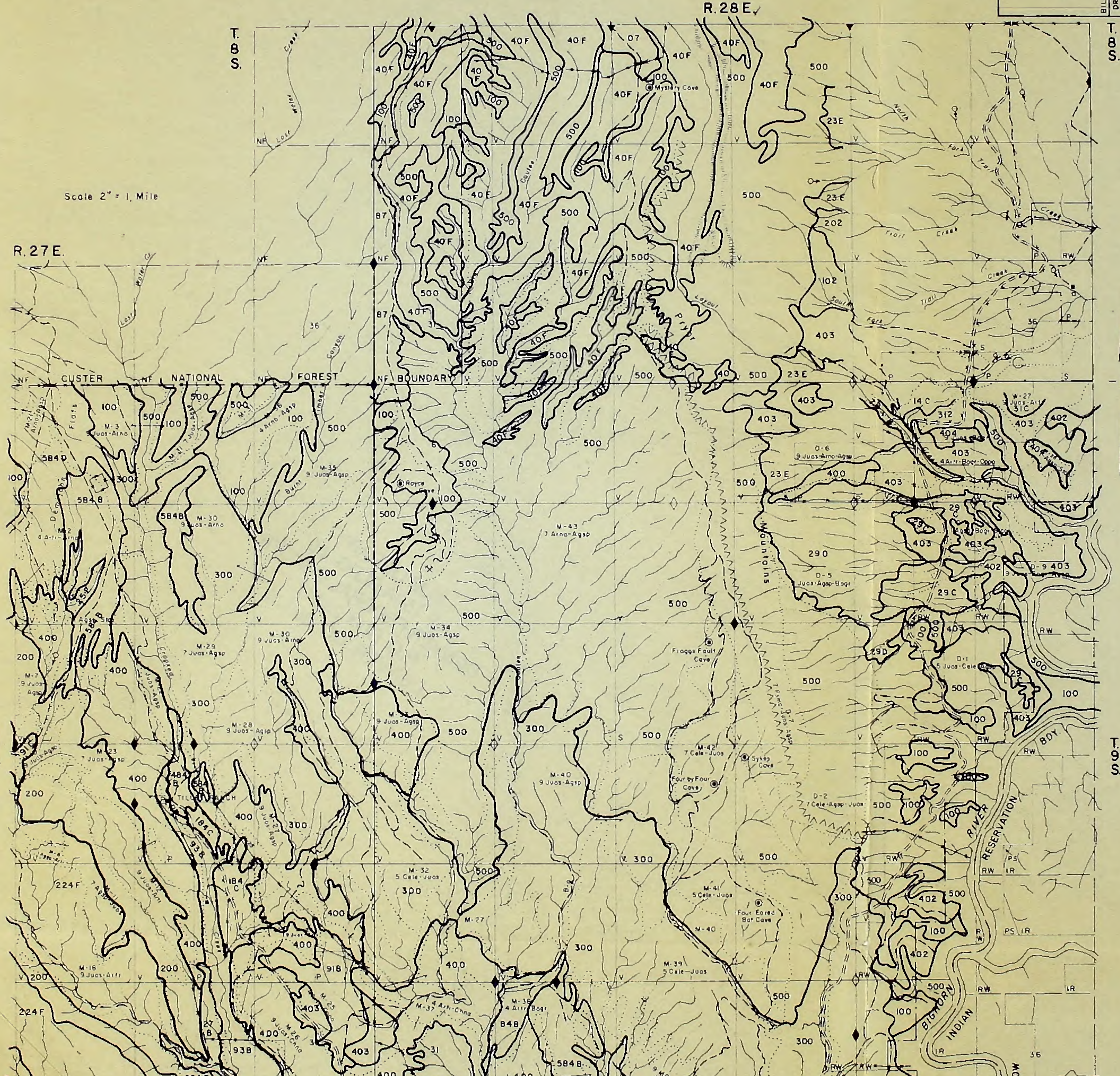
PRYOR MOUNTAIN SOIL SURVEY

BILLINGS DISTRICT — BILLINGS, MONTANA

DRAWN BY- A.R.S.
TRACED BY-
CHECKED BY-
PROGRAM-
DISTRICT OFFICE-
DATE- MAY 1968
DRAWING NO.
SHEET NO.

Map Unit Symbols	Series Name	Slope
07	Reve stony loam	8-30%
7B	Alluvial land - loamy	0-6%
14B	Darre silt loam	2-4%
14C	Darre silt loam	4-8%
23E	Utica cobbly loam	15-35%
27B	Hysham clay loam	2-4%
29C	Crago stony and gravelly loam	4-8%
29D	Crago stony and gravelly loam	8-15%
31C	Rentsac channery loam	4-8%
40F	Skaggs-Trapper Mollic variant silt loam and channery silt loam	35-70%
79	Snowy-Branson stony loam	5-20%
81C	Travessilla silt loam	4-8%
81D	Travessilla silt loam	8-15%
84B	Shorey loam	2-4%
87	Lap-Duncom Association	8-25%
91B	Demijohn silty clay loam	2-4%
91C	Demijohn silty clay loam	4-8%

Map Unit Symbols	Series Name	Slope
93B	Bowler silt loam	2-4%
98	Duncom silt loam	8-25%
100	Lap association	8-20%
102	Lap-Hound complex	15-35%
184C	Shorey gravelly clay loam	4-8%
200	Shale outcrop	over 90%
202	Judith soils	8-20%
216	Gurney silt loam	8-45%
224F	Midway and Travessilla soils - Rocky association	45-75%
300	Sandstone Rockland	over 90%
400	Red shale and Abac soils complex	50-90%
402	Abac-Relan variant complex	15-50%
403	Abac stony loam	15-35%
404	Abac-Judith variant complex	15-45%
484B	Shorey clay loam	2-4%
500	Limestone Rockland	over 90%
584B	Shorey gravelly and stony loam	2-6%



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